

## Contribution to the identification of medicinal plants used against COVID-19 in North-West Morocco

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The coronavirus disease 2019 (COVID-19) affects humans, who are now developing a milder form of the illness. In addition to the use of available drugs, the local populations in Morocco used medicinal plants during the pandemic. The current study aimed to document and to research the level of use of traditional medicine using plants in Morocco. Ethnobotanical surveys were conducted on the perceptions and level of use of plants through a case study in North-West Morocco. The methodology is based on targeted surveys, from April to September 2021, of households that have had cases of infection with COVID-19. Five hundred surveys were randomly and systematically distributed in the study area to highlight the medicinal use of plants to treat COVID-19 and its consequences for health and well-being. The results showed the attachment of the populations to traditional medicine with the use of plants available in the study area (local forest area and herbalists). The 23 species used by the populations in question against COVID-19 belong to 12 families. The analysis shows the dominance of the Lamiaceae family with nine species, followed by Asteraceae with three species. The Lamiaceae family have proven marked performance in the fight against COVID-19. The results obtained offer orientations for the enhancement of the beneficial effects of traditional medicine and clinical trials remain to be carried out. The current results highlight that flora can be a source for the discovery of medicinal agents active against COVID-19.

**Keywords:** traditional medicine; herbal medicine; medicinal plants; ethnobotanical surveys.

### Introduction

A new coronavirus, 2019-n-CoV, which caused a pandemic of pulmonary disease in the city of Wuhan, has since spread globally (Guo et al., 2020; Wu et al., 2020). The coronavirus disease 2019 (COVID-19) is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which is considered a global public health problem. Historically, humans have used natural resources and products, such as plants, animals, microorganisms, and marine organisms, in medicines to relieve and treat disease. According to fossil records and analyses, humans have used plants for treatment of diseases (herbal medicine) for at least 60,000 years (Shi et al., 2010).

Chinese traditional herbal medicine played an important role and has a long background in the treatment and control of several epidemic diseases from plague to SARS. It was used for the treatment of the SARS-CoV outbreak in 2002. Traditional medicine was reported to have been effective in controlling SARS disease (Amir & Lebar, 2020). Like traditional Chinese medicine, Indian and Iranian medicine also suggests some medicinal plants for the prevention, treatment and fight against diseases of viral origin, including COVID-19. Some studies showed that the Chinese herbal formula may be associated with viral replication and blocking of the viral proliferation (Li & Peng, 2013; Wu et al., 2020). Chinese herbal medicine combined with western medicine have suggested a regimen which decreases viral complications. On 24 January 2020, the first patient with symptoms of COVID-19 pneumonia was discharged from hospital after treatment with traditional Chinese herbal medicine (Amir & Lebar, 2020). Medicinal plants are certainly a promising field for treatment of several diseases. In this context, they can be considered as new option for

their role in overcoming viral transmission (Balachandar et al., 2020). In addition to traditional medicine, research shows that people with greater trust in national health systems are more up-to-date with vaccination and other health services (Barello & Graffigna, 2020).

Presently, concerted efforts are ongoing in finding effective herbs and herbal compounds for the management COVID-19 disease (Hordofa et al., 2020). However, as this is a new disease, there is a dearth of information on herbs that are utilized for this purpose.

All over the world, there is a deep attachment to popular traditions to protect against the Covid-19. In search of traditional recipes, many populations believe in the miraculous power of plants, strengthening their immunity to protect themselves from Covid-19 (Guo et al., 2020; Hordofa et al., 2020; Bhardwaj et al., 2021). Several studies have focused on the role of medicinal plants in the treatment of COVID-19 (Kapepula et al., 2020; Wu et al., 2020; Oderinlo et al., 2021).

As of 10 October 2022, according to the Moroccan Ministry of Health and Social Protection, the number of COVID-19 cases reported since the start of the outbreak of the virus rose to 1 265 093. The ministry urges citizens to observe all rules and implement the precautionary measures issued by the authorities. Unfortunately, despite different vaccines, there is no effective anti-COVID-19 drug so far. The use of medicinal plants is a major challenge in relieving and treating COVID-19 disease.

In Morocco, several ethnobotanical and medicinal plant studies have been carried out and have demonstrated the wide use of medicinal plants for the treatment of diseases in both rural and urban areas (Alaoui & Laaribya 2017; El Hachlafi et al., 2020). Indeed, Moroccan history has proved the phytotherapeutic application of herbal traditional medicine to cure and alleviate ailments (Aanouz et al., 2021). Furthermore, the population's

medical usage of plants is becoming increasingly important in the fight against COVID-19. Traditional medicine, which has always existed, is defined as the sum of all knowledge, skills, and practices that are founded on a culture's ideas, beliefs, and experiences and are used to keep people healthy as well as prevent, diagnose, treat, and cure diseases (Gao et al., 2007). In this context, our research is aimed at the impact of herbal traditional medicine, such as the usage of medicinal herbs, as potential COVID-19 treatments. The objective of our work is to highlight the inventory of medicinal plants and the perception of local populations as to the use of plants and their potential effectiveness against COVID-19. This will push scientists to seek and find the molecules that can prevent COVID-19 infection.

## Materials and methods

Our investigations and our questionnaires were addressed to the populations of the forest zone of Maamora Forest, which is situated in the northwest of Morocco close to the Atlantic Ocean, between 6° and

6° 45' W and 34° and 34° 20' N. The study area is covered by four provinces (Salé, Kénitra, Sidi Slimane and Khémisset, Fig. 1). It is an area rich in biodiversity and in aromatic and medicinal plants (Alaoui & Laaribya, 2017; Laaribya et al., 2021).

The study area concerns the forest region of Maamora Cork Oak Forest, which is characterised by rich biodiversity and traditional rural livelihoods, representing an important source of income derived from the production of ecosystem services such as aromatic and medicinal plants that play a key role in ecological processes, such as water retention, soil conservation or carbon storage (Gil & Varela, 2008). Local people's therapeutic usage of plants has traditionally been one of the strategies to battle diseases.

Traditional medicine has developed in the area over time as a result of knowledge and practices based on people's own beliefs and experiences. Maamora Cork Oak Forest, the subject of our research, is the world's biggest lowland cork forest, covering 133 000 ha and includes 60 000 ha of pure cork oak. It is a very important place for the inhabitants of huge urban agglomerations.

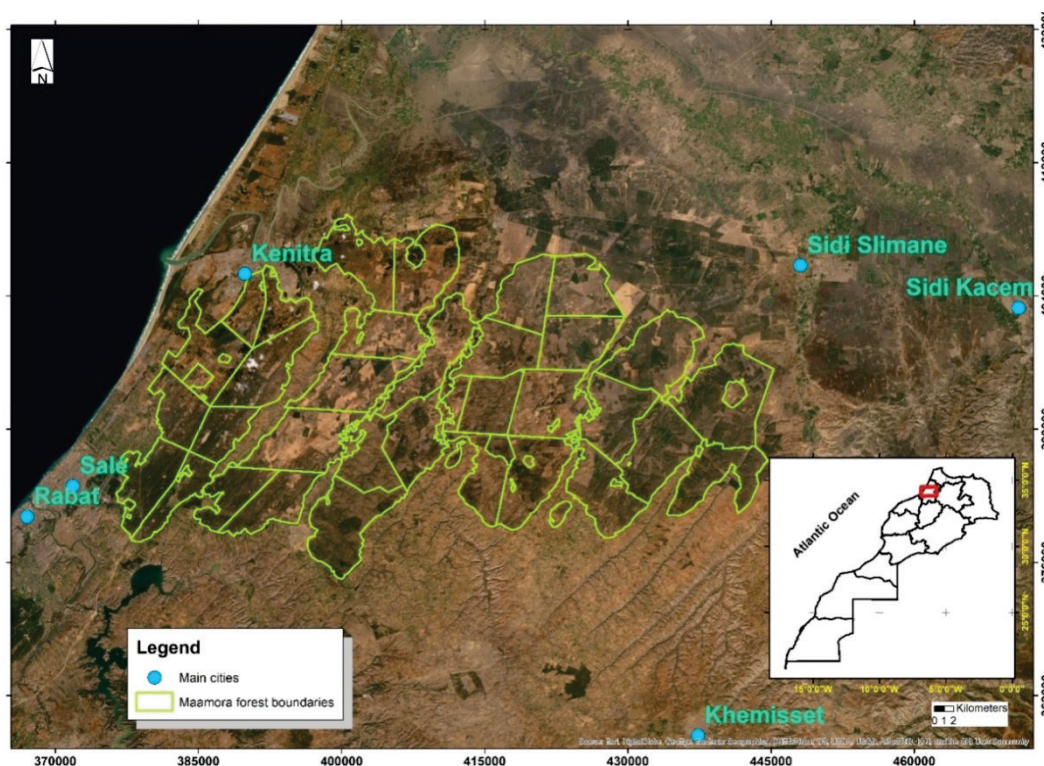


Fig. 1. Study area (Maamora Forest-Northwest of Morocco)

Our research involved 500 face-to-face surveys performed from April to September 2021, utilizing a structured and semi-structured questionnaire to achieve the aims. All the participants provided prior informed consent before the interviews. The location and size of the sample studied are determined using the random, systematic, and simple sampling method geared towards households having had at least one case of COVID-19 since the start of the COVID-19 pandemic in Morocco. The respondents mentioned all the species by their common local name as mentioned in Table 3. Ethnobotanical analysis was performed with the SPSS software to calculate common quantitative ethnobotanical indices per medicinal species declared (frequency and Use-Value were used to quantify the relative importance of useful medicinal plants).

Use Value (UV): UV determines the most frequently used plant species. The UV was calculated on the basis of the following formula:

$$UV = \frac{\sum U}{N}$$

where U is the number of uses for a plant species mentioned by each informant and N is the total number of informants who cited this species.

The distribution of the number of households was made expressly to cover the rural and urban territorial communities in the study area (Fig. 1) which covers the Maamora Forest area (Northwest of Morocco). Indeed,

four (4) cities, 17 territorial municipalities were concerned in the area covered by our investigations (Table 1). The study area overlaps between several cities as shown in the following table (Salé, Kénitra, Sidi Slimane and Khémisset).

Questionnaires were conducted mainly on the following issues:

- sociodemographic characteristics;
- use of plants against COVID-19 and source of information;
- perception of symptoms of COVID-19;
- duration of symptoms;
- medical treatment to treat COVID-19;
- list the medicinal plants used to treat COVID-19;
- local name and source of plants;
- part used of each plant and method of preparation;
- level of satisfaction.

## Results

Among the 500 respondents, 260 (52%) were male and 240 (48%) were female. The largest proportion of the respondents (42%) was between 35 and 50 years old followed by the age category 50 to 65 (29%).

The largest group of the respondents was illiterate (29%) followed by those who had received secondary education (26%). Most of the respondents are farmers (35%), followed by jobless (22%), students (17%) and salespersons (11%, Table 2).

**Table 1**  
Breakdown of surveys by city and municipalities

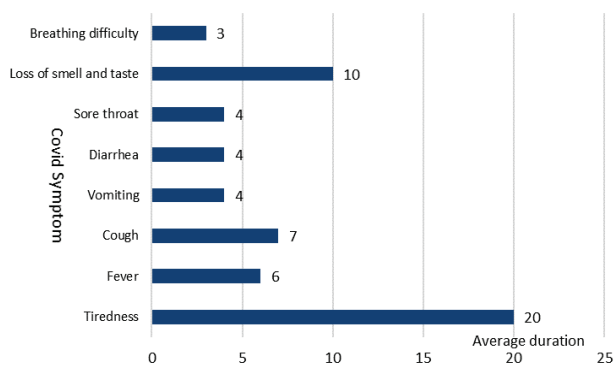
City	Municipalities	Surveys (number)	%
Kénitra	5	136	27.1
Sidi Slimane	2	106	21.3
Khémisset	7	207	41.4
Salé	3	52	10.3
Total	17	500	100.0

**Table 2**  
Sociodemographic characteristics of the participants

Variables	Parameters	Total	Percentage
Gender	male	260	52
	female	240	48
Age groups	<20	15	3
	20–35	75	15
	35–50	210	42
	50–65	145	29
	>65	55	11
Educational level	illiterate	147	29
	primary	95	19
	secondary	131	26
	university	127	25
Occupation	jobless	109	22
	farmers	176	35
	students	85	17
	technicians	25	5
	teachers	13	3
	salespersons	57	11
	doctors	11	2
	drivers	35	7
	retired	24	5
	Income level	low	174
medium		263	53
high		63	13

The analysis of the different COVID-19 symptoms felt shows that 90% of the population surveyed experienced severe fatigue. This symptom was very often accompanied by fever (85%) and cough (80%). Other common confirmed symptoms included vomiting (62%), diarrhea (60%), sore throat (50%), loss of smell or taste (40%) and difficulty breathing (35%).

The average duration of these symptoms is also variable (Fig. 2); we recorded an average duration of 20 days for tiredness, 10 days for loss of smell or taste, 7 days for cough and 4 days for vomiting, diarrhea and sore throat. Although difficulty in breathing affected a relatively small segment of the infected population (35%) for only an average duration of 3 days, this symptom is considered the most severe and the most frightening. People with this symptom have reported that they have suffered a lot and have resorted to the use of several medicinal plants in order to relieve themselves of the symptom.



**Fig. 2.** Average duration of symptoms

Several herbal medicinal plants have been used to sometimes relieve the pain felt or to seek something close to a cure (Table 2). A total of 23 plants were identified by the sick respondents to deal with COVID-19. The greatest number of these plants were used to attack flu-like symptoms (6 plants) and overcome difficulty in breathing (6 plants). According to the population surveyed, no medicinal plant was used to relieve or restore the sense of smell or taste.

In addition, 60% of individuals in the infected population surveyed declared that they had recourse to both traditional medicine and the conventional medical treatment in force in Morocco (chloroquine, antibiotics, vitamin C, vitamin D and zinc).

In addition, in order to mitigate the spread of the virus and provide protection to relatives, the entire population surveyed complied with the instructions of the State by respecting the minimum distance of 1 m between individuals outside homes and in workplaces, wearing masks and good hygiene by washing hands regularly. Sick people had to confine themselves to separate rooms for a minimum of 14 days from the date of the start of medical treatment. Herbal medicines have been used to treat the main symptoms of COVID 19, namely:

- cough was treated with three species: *Artemisia absinthium* L., *Linum usitatissimum* L. and *Diploaxis catholica* L.;
- sore throat was treated with one species: *Citrus limon* L.;
- diarrhea was treated with three species: *Mentha spicata* L., *Rosmarinus officinalis* L., *Pimpinella anisum* L.;
- vomiting was treated with three species: *Salvia officinalis* L., *Camellia sinensis* L. (Kuntz) and *Pimpinella anisum* L.;
- flu-like symptoms were treated with eleven species: *Chamaemelum mixtum* L., *Lavandula stoechas* L., *Mentha longifolia* L., *Origanum majorana* L., *Thymus vulgaris* L., *Trigonella foenum graecum* L., *Nigella sativa* L., *Foeniculum vulgare* (Miller), *Zingiber officinale* Roscoe, *Camellia sinensis* L.(Kuntz) and *Citrus limon* L.;
- breathing difficulty was treated with six species: *Artemisia herba alba* Asso, *Origanum vulgare* L., *Rosmarinus officinalis* L., *Eugenia caryophyllus* (C. Spreng) Bull and Harr, *Eucalyptus globulus* Labill. and *Lavandula multifida* L.

A total of 11 medicinal plants were gathered directly from the Maamora Forest, among the 23 plant species utilized by the community questioned and recognized by their local names (Table 4). The medicinal and aromatic plants (MAPs) found in Maamora's natural forest have a high potential as a therapeutic and economic source for the local inhabitants. The other 12 species come from herbalists. So, depending on the symptoms, one herbal remedy or a mixture of herbal supplements was utilized. The use value index (UV) showed that species of the Lamiaceae family were ranked first (Table 3).

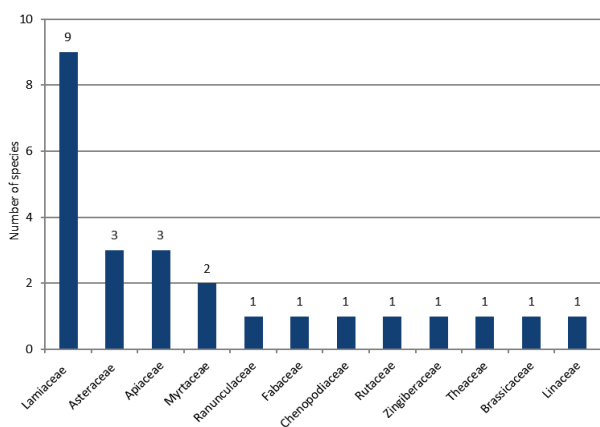
The results also revealed that leaves are the most frequently used part of medicinal plants, followed by seeds. The choice of utilising leaves is explained by their availability, collection and simplicity in the preparation of the translational medicines in question. It should be noted that photosynthesis takes place in leaves, and sometimes the storage of secondary metabolites is effective for the biological characteristics of the medicinal plant. Comparable results also showed that the leaves were the main part of the plant in Morocco and in North Africa for the preparation of herbal medicines.

During the surveys, all species were recognized and grouped into families (Fig. 3). Furthermore, the 23 species used against COVID-19 by the surveyed populations are divided into 12 botanic families. The Lamiaceae family dominates the results with 9 species, followed by the Asteraceae family with 3 species. The Apiaceae and Myrtaceae families each have two species, whereas the other families (Brassicaceae, Chenopodiaceae, Fabaceae, Linaceae, Ranunculaceae, Rutaceae, Theaceae, and Zingiberaceae) each have one.

The degree of importance given to the use of plants against COVID-19 (Fig. 4), both in duration and frequency, is highly variable. In fact, 90% of respondents declared that they used *Camellia sinensis* L. (Kuntz) and 70% used *Eugenia caryophyllus* (C. Spreng.) Bull. and Harr., followed by *Mentha spicata* L., *Citrus limon* L., *Artemisia herba alba* L., *Rosmarinus officinalis* L., *Zingiber officinale* L. and *Foeniculum vulgare* (Miller) with frequency of use respectively 60%, 56%, 54%, 51% and 50%. The other species had a frequency of use lower than 50%.

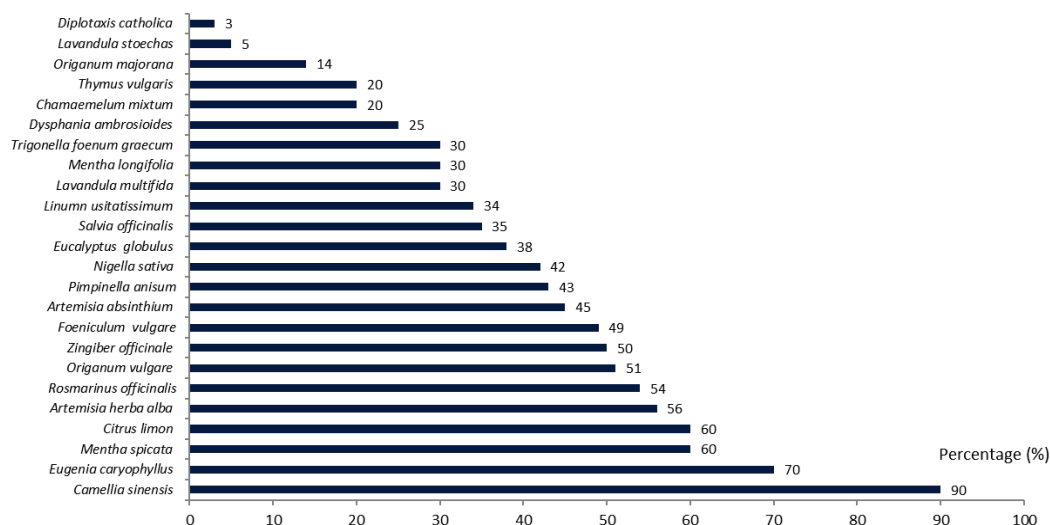
**Table 3**  
List of herbal plants used against Covid-19

Family	Herbal plants	Part Used	Mode of preparation	Mode of administration	Local name	Origin	Use value
Asteraceae	<i>Chamaemelum mixtum</i> L.	leaf and flowers	infusion	oral	Babounj	Herbalist	0.61
Asteraceae	<i>Artemisia absinthium</i> L.	leaf	infusion	oral	Chiba	Maamora Forest	0.55
Asteraceae	<i>A. herba-alba</i> (Asso.)	leaf	infusion	oral	Chih	Herbalist	0.87
Lamiaceae	<i>Lavandula multifida</i> L.	leaf, flower	infusion	smell	Khezama	Maamora Forest	0.61
Lamiaceae	<i>L. stoechas</i> L.	leaf, flower	infusion	oral	Lhalhal	Herbalist	0.57
Lamiaceae	<i>Mentha longifolia</i> L.	leaf	infusion	oral	Mentha	Herbalist	0.88
Lamiaceae	<i>M. spicata</i> L.	leaf	infusion	oral	Naaanaa	Maamora Forest	0.82
Lamiaceae	<i>Origanum majorana</i> L.	flower	infusion	oral	Mard'douch	Maamora Forest	0.88
Lamiaceae	<i>O. vulgare</i> L.	leaf	infusion	oral	Zaatar	Maamora Forest	0.93
Lamiaceae	<i>Rosmarinus officinalis</i> L.	leaf	infusion	oral/smell	Azir	Maamora Forest	0.86
Lamiaceae	<i>Salvia officinalis</i> L.	leaf	infusion	oral	Salmia	Maamora Forest	0.82
Lamiaceae	<i>Thymus vulgaris</i> L.	leaf	infusion	oral	Zaaitra	Maamora Forest	0.94
Ranunculaceae	<i>Nigella sativa</i> L.	seed	powder	oral	Sanouj	Herbalist	0.54
Fabaceae	<i>Trigonella foenum graecum</i> L.	seed	powder, condiment	oral	Lhalba	Herbalist	0.48
Myrtaceae	<i>Eugenia caryophyllus</i> (C. Spreng.) Bull. and Harr.	flower buds	infusion	smell	Kerenfel	Herbalist	0.72
Myrtaceae	<i>Eucalyptus globulus</i> Labill.	leaf	infusion	smell	Klitouss	Maamora Forest	0.66
Apiaceae	<i>Pimpinella anisum</i> L.	seed	infusion	oral	Habbat halawa	Herbalist	0.52
Apiaceae	<i>Foeniculum vulgare</i> (Miller)	root and fruit	powder, infusion	oral	Nafaa beldi	Herbalist	0.65
Chenopodiaceae	<i>Dysphania ambrosioides</i> L.	leaf	infusion	oral	M'khinza	Herbalist	0.58
Rutaceae	<i>Citrus limon</i> L.	fruit of the lemon	juice	oral	Lhamed	Maamora Forest	0.66
Zingiberaceae	<i>Zingiber officinale</i> Roscoe.	leaf	infusion, condiment	oral	Skin jbir	Herbalist	0.59
Theaceae	<i>Camellia sinensis</i> L. (Kuntz)	whole plant	infusion	oral	Atay	Herbalist	0.72
Brassicaceae	<i>Diplotaxis catholica</i> (L.)	leaf	infusion	oral	L-kerkaz	Maamora Forest	0.68
Linaceae	<i>Linum usitatissimum</i> L.	seed	infusion, powder	oral	Zariat el kettan	Herbalist	0.45



**Fig. 3.** Importance of plant families according to the number of species

To find out the effect of traditional treatments against COVID-19, we asked respondents about the level of their satisfaction with the use of medicinal plants. Indeed, from their statements we found that people who did



**Fig. 4.** Level of use of medicinal plants by the population

not use the protocol prescribed by the State were more satisfied with the use of medicinal plants than those who used the protocol for home treatment of coronavirus patients.

According to the results obtained, the species which were highly appreciated by the patients are *Eugenia caryophyllus* L., *Artemisia herba alba* L., *Origanum vulgare* L., *Zingiber officinale* Roscoe., *Citrus limon* L., and *Rosmarinus officinalis* L. Indeed, the percentage of satisfaction with the use of these plants for the first category of patients is respectively 80%, 70%, 60%, 52%, 51%, 50%. Statistics also showed that some species which the local population found less effective, in particular *Camellia sinensis* L. (Kuntz), *Mentha spicata* L., and *Foeniculum vulgare* (Miller).

## Discussion

It is well known that traditional medicine plays an important role in the fight against diseases and strongly affects human survival. The use of natural resources as medicines has posed a great challenge to humans over time. Indeed, early humans were able to develop knowledge about natural medicines (Tinitana et al., 2016; Ahmad et al., 2018; Amjad et al., 2020). The greatest medicines come from natural resources and more particularly from plant species.

Human history is also the history of herbal traditional medicines used to treat and prevent various diseases. Humans have not ceased to carry out research to counter the danger of viruses and various serious diseases to guarantee the survival of the human species. Indigenous knowledge and practices have a role to play in providing solutions to the world's problems. Traditional medicine has benefited considerably from historical knowledge of the uses of plants and the various compounds found in natural resources. It is therefore necessary to make full use of this traditional knowledge to improve the efficiency of modern medicine and drugs while integrating safety standards. Amir & Lebar (2020) have reviewed the latest updates on traditional medicines proposed for the treatment of COVID-19.

Natural resources have always attracted scientists to search for new drugs to prevent and fight diseases. COVID-19 caused by the new coronavirus is a deadly infectious disease against which no specific drug or vaccine is yet fully effective. Medicinal plants are considered very useful by traditional healers in Morocco to prevent and treat several diseases and conditions. Since the outbreak of the COVID-19 pandemic, various traditional treatments based on local medicinal plants have been used and have had positive effects on the health of COVID-19 patients, mainly in our study area. In our study, both genders and all age groups are interested in the same way in herbal medicines. However, the number of male participants was higher (52%) than that of females (48%). However, we concluded that as income and education levels increase, experience with traditional herbal medicine decreases. Therefore, advanced education reduces the ancestral therapeutic knowledge of new generations. Previous ethnobotanical studies (Benlamdini et al., 2014; Chaachouay et al., 2020) report similar results.

In the present study, which aimed to highlight medicinal plants in the fight against the COVID-19 pandemic in the Maamora Forest area (Morocco), local populations treated patients using 23 species of medicinal plant. The species belong to 12 botanical families including especially Lamiaceae with 9 species, followed by Asteraceae with 3 species. This result is in concordance with those of previous studies conducted in Sale region (Morocco) (El Alami et al., 2020; Chaachouay et al., 2021); in Fez region (Morocco) (Benkhaira et al., 2021), and in the Middle Atlas region (Morocco) (Hamamouch & Plants 2020).

The plants used appear to be very valuable to local populations as a treatment for the pandemic due to the presence of antioxidants, anti-viral and antimicrobial constituents. Indeed, the analysis of the results shows that the main medicinal plants used have antioxidant activity, namely the Lamiaceae family. These results are in agreement with several recent works presented in Table 4.

Lamiaceae is one of the most important medicinal plant families, well known for various biological and medicinal effects. Several studies have reviewed the antiviral potential of the previously mentioned herbs that have been discussed so far, with particular emphasis on antiviral properties (Bekut et al., 2018). Antiviral effects of Lamiaceae plants have mainly been proven *in vitro*, with some effects also having been confirmed in other types of experiments, such as indirect effects in healthy volunteers, or in patients (Yamasaki et al., 1998; Schnitzler et al., 2007; Farsani et al., 2016). Plants from this family are well known for their antibacterial, antifungal and antioxidant properties (Mimica-Dukić et al., 2003; Bozin et al., 2006; Bozin et al., 2007).

The beneficial effects of these traditional medicines and their clinical trials still remain to be researched. Indeed, the current results highlight that flora can be a basis source for the finding of medicinal agents active against COVID-19.

## Conclusion

Herbal traditional medicine occupies an important place in the therapeutic arsenal of the population. It plays an important role among the Moroccan local population. The people depend on traditional medicine to treat several diseases because they have the efficacy of herbal medicine, and they have limited economic means to access modern medicine.

Respondents surveyed identified 23 plants used to deal with COVID-19. The greatest number of these plants were used to attack flu-like symptoms (6 plants) and overcome difficulty in breathing (6 plants). According

to the population surveyed, no medicinal plants were used to relieve or restore the sense of smell or taste during the disease.

**Table 4**

Major indication of the main plants used

Families	Species	Major effects or indications	References
Lamiaceae	<i>Lavandula multifida</i> L.	anti-inflammatory, antibacterial, immune, antiviral, antioxidant activity	Sosa et al. (2005), Fazio et al. (2017), Bekut et al. (2018)
Lamiaceae	<i>Lavandula stoechas</i> L.	anti-inflammatory, anti-leishmanial, antimicrobial, antiviral, antibacterial, antioxidant activity	Gören et al. (2002), Cherrat et al. (2014), Asghari et al. (2016), Loukhaoukha et al. (2018)
Lamiaceae	<i>Mentha longifolia</i> L.	cytotoxic, antibacterial, antioxidant, gastrointestinal activity, and nervous system effects	Mimica-Dukić et al. (1999), Ghoullami et al. (2001), Al-Bayati (2009), Razavi et al. (2012)
Lamiaceae	<i>Mentha spicata</i> L.	treatment of flatulence related to indigestion, antimicrobial, antioxidant, anticancer, anti-inflammatory, hepatoprotective activities	Govindarajan et al. (2012), De Sousa Barros et al. (2015), Snoussi et al. (2015), Mahboubi (2021)
Lamiaceae	<i>Origanum majorana</i> L.	antibacterial, antioxidant, antimicrobial, antifungal, anti-inflammatory activity, treatment of respiratory, gastrointestinal problems	Škrovánková et al. (2012), Hossain et al. (2012), Chenna et al. (2018)
Lamiaceae	<i>Origanum vulgare</i> L.	insecticides, antibacterial, antioxidant, antibacterial, antifungal activity	Andi & Maskani (2021), Leonelli Pires de Campos et al. (2022)
Lamiaceae	<i>Rosmarinus officinalis</i> L.	antioxidant, anti nociceptive, antiviral, anti-proliferative, antibacterial, antidiabetic, anti-inflammatory, antitumor activity	Drienovská et al. (2020), Kumar et al. (2021), Amina et al. (2022), Sabry et al. (2022)
Lamiaceae	<i>Salvia officinalis</i> L.	antioxidant, antibacterial, estrogenic, antimutagenic, antinociceptive, anticancer, anti-inflammatory, antimicrobial, antimentia, hypoglycemic, hypolipidemic activity	Sepide & Sara (2016), Assaggaf et al. (2022)
Lamiaceae	<i>Thymus vulgaris</i> L.	insecticides, antibacterial, antioxidant, antioxidant, fungicidal, anti-inflammatory, antiviral, anti-cancerous activities	Prasanth et al. (2014)
Asteraceae	<i>Artemisia herba alba</i> Asso.	antioxidant, antibacterial, antimicrobial, insecticidal, antispasmodic activities	Bertella et al. (2018), Benabdallah et al. (2022), Amina et al. (2022)

Thus, 23 species of medicinal plants belonging to 12 botanical families were used. The Lamiaceae are the most represented family in terms of frequency of use (9 species); it is the family of medicinal species par excellence. The treatments were prepared using different parts of the plant and according to different modes. Several studies confirmed our result especially the antiviral effects of Lamiaceae plants, which have mainly been proven *in vitro* with some effects also having been confirmed. All results require further *in-vitro* and *in-vivo* experimental indication.

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